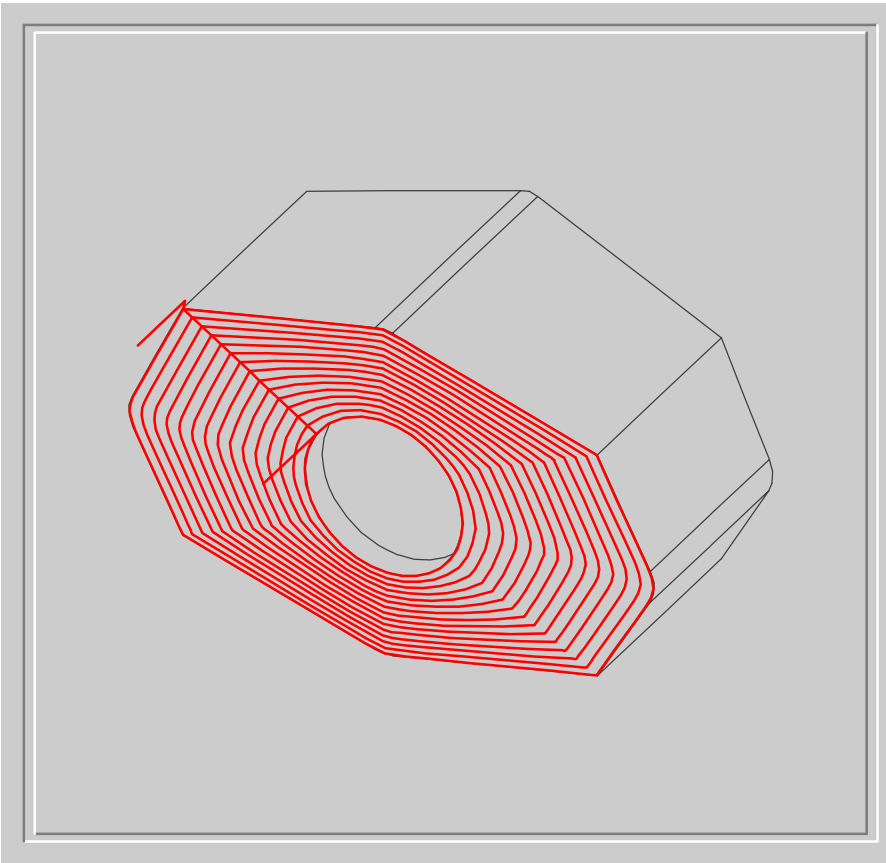


Creating Flowline Operations

I-DEAS™ Tutorials: Milling Projects

Flowline is a 3-axis milling operation used for surface finishing. It follows the contours of the part similar to UV machining. You can use flowline operations to reduce hand finishing and machining times on contoured parts.

In this tutorial, you'll learn different techniques for defining flowline operations. You'll learn how to control the shape and size of the cutting passes and how to modify the cut and stepover directions.

Learn how to:

- pick flow and control lines
- change cut and stepover directions
- pick flow lines only

Before you begin...

Prerequisite tutorials:

- all tutorials under the Modeling Fundamentals menu
- Introduction to Generative Machining
- Building a Setup Assembly
- Generating In-process Stock and Checking Validity
- Working with Tools and Tool Catalogs
- Picking Holes
- Setting Machining Parameters for Hole-making Operations

The file you need for this tutorial is distributed with the product. You must copy it into your local directory.

Move to the local directory where you want to copy the file. Then:

In UNIX:

```
cp $SDRC_INSTL/examples/nc/tut_flowline.arc .
```

In Windows use:

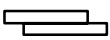
```
copy %SDRC_INSTL%\examples\nc\
tut_flowline.arc .
```

If you can't copy the file, you may have to set up the variable needed to copy from the I–DEAS installation.

```
. sdrc_oadev
```

If you can't access the file, contact your system administrator. The file may not be installed.

If you didn't start I-DEAS with a new (empty) model file, open a new one now and give it a unique name.


File
Open


Model File Name: any unique name

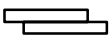

OK

Make sure you're in the following application and task:


Application: Manufacturing


Task: Generative Machining

Set your units to inches.


Options
Units


Inch (pound f)

Import the archive file that contains the parts and tools that you need to complete this tutorial. Importing an archive file can take several minutes. Be patient.

File
Import

Import Selections form


I–DEAS Archive File
OK

File Name Input form

Archive file name: tut_flowline.arc
OK

The Manufacturing application quits, an informational message is displayed (the message will dismiss automatically), and the archive file is imported.

Import Archive File Status

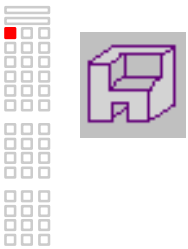

Check *I-DEAS List*.

Be sure to check the List region to be sure that the parts imported properly.

Dismiss

A second informational message is displayed (the message will dismiss automatically) and the Manufacturing application starts.

Create a job.



NC Job Create form

Job Name: Flowline Job

OK

Add the part to the job.

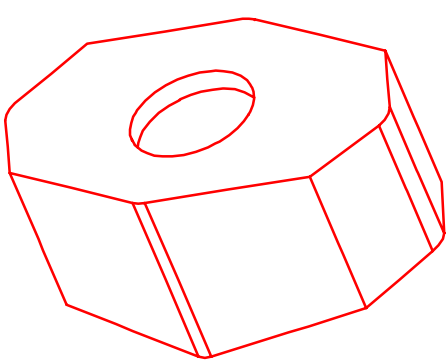
Get

From Bin/Library

Select Part/Assembly form

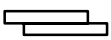
tut_flowline

OK



The part is located relative to the global-space coordinate system with the origin at the center of the workplane. You can view the global-space coordinate system by picking *Workplane Appearance...,* then toggling on *Display Origin* on the *Workplane Attributes* form.

Recovery Point



File
Save

Warning!

If you're prompted by I-DEAS to save your model file, respond:

No

Save only when the tutorial instructions tell you to—not when I-DEAS prompts for a save.

If you make a mistake at any time between saves and can't recover, you can reopen your model file to the last save and start over from that point.

Hint

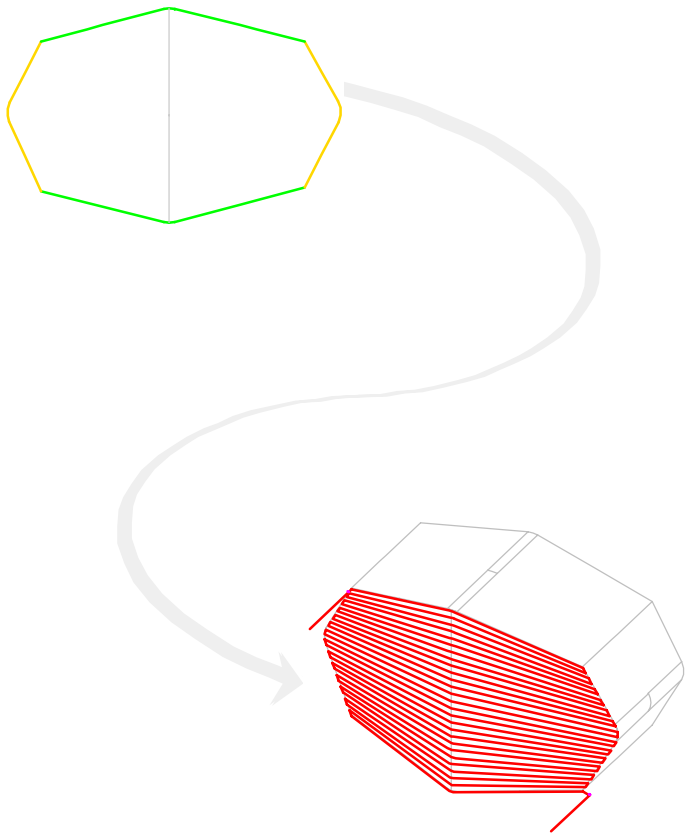
To reopen your model file to the previous save, press Control-Z.

You define a flowline operation by picking sets of curves or edges:

- flow lines—determine the shape and direction of the cutting passes
- control lines—determine the ends of the cutting passes

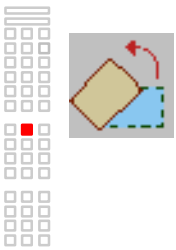
The software then interpolates the cutting passes from the closed boundary that the flow and control lines form.

In the next steps, you'll pick edges on a part as flow and control lines and then generate a toolpath.



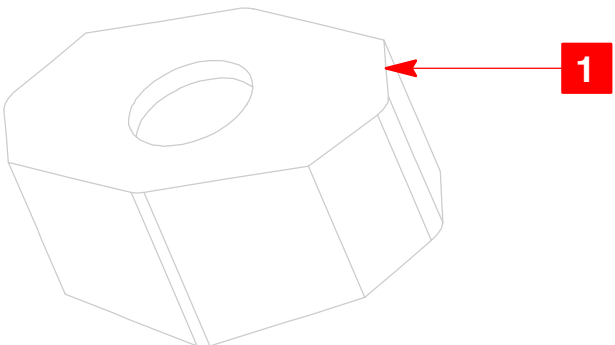
What: Rotate the part about the X axis so the surface to be machined aligns with the Z axis. The Z axis represents the axis of rotation for the tool spindle.

How:



1 anywhere on the part

(twice)



Check *I-DEAS Prompt*.

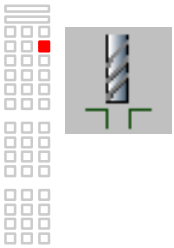
Enter rotation angles: 180, 0, 0

Recovery Point

File
Save

What: Create a flowline operation.

How:



Operation Selection form

Category: *Milling*

Type: *Flowline*

Create

Don’t close the Operation Specification form.

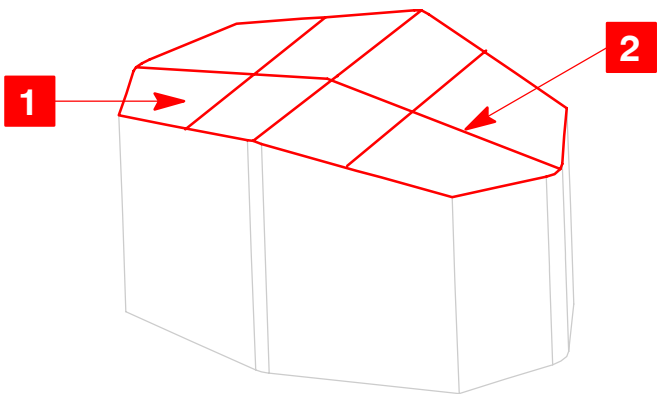
What: Pick the surfaces to be machined.

How:

Operation Specification form

1

2 shift pick



Surface Selection form

 *Dismiss*

Don’t close the Operation Specification form.

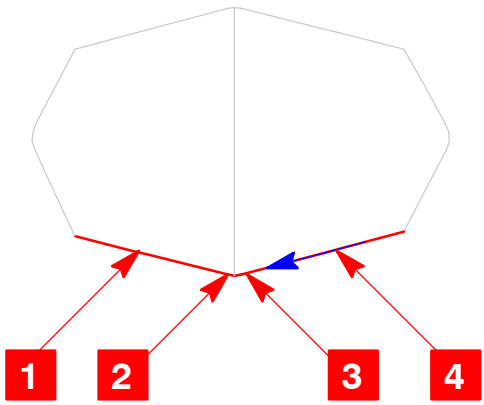
What: Pick the edges that represent the first flow line. The first flow line defines the shape and the cut direction of the toolpath.

How:

Operation Specification form

Machining Parameters: Cut form

1. E23
2. E36
3. E37
4. E21



Flow Curve Sets form

 Change arrow direction, if necessary.

 Don’t close the Flow Curve Sets form.

What: Pick the second flow line.

How: Make sure the cut direction of the second flow line is the same as that of the first, otherwise the cutting passes will overlap.

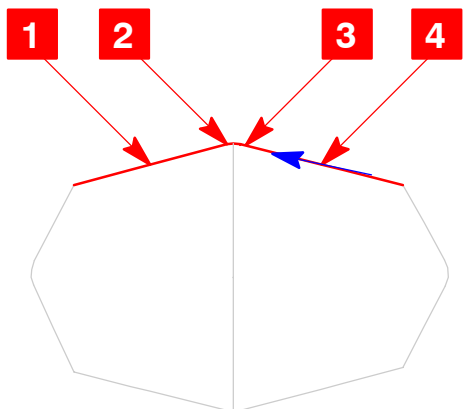
Flow Curve Sets form

1 E31

2 E39

3 E40

4 E33

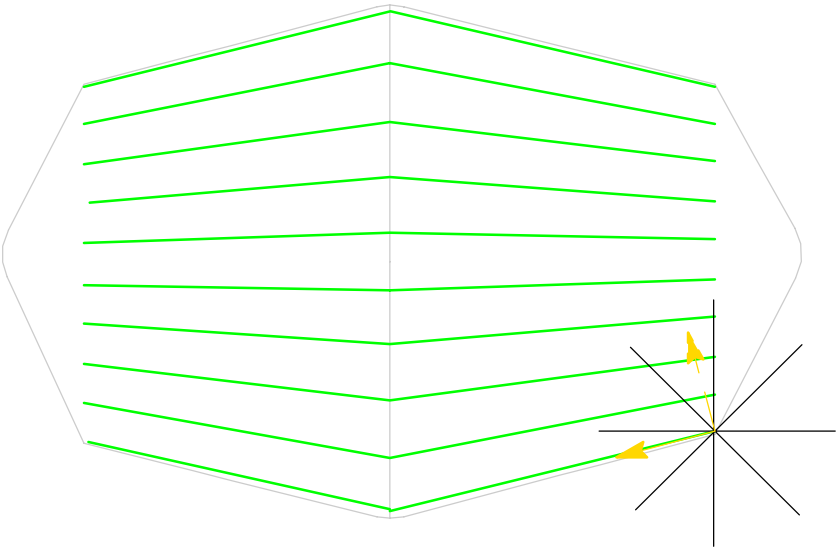


Change arrow direction, if necessary.

OK

Don’t close the Machining Parameters: Cut form.

Result



Things to notice

The preview of the toolpath doesn't cover the surfaces completely. Remember, the software generates the cutting passes from the closed boundary of the selected flow and control lines. If you don't pick control lines to form a closed boundary, the software derives them from the endpoints of the edges that you did select. Notice the cutting passes end at straight lines from the ends of the flow lines.

Also, the solid arrow coming from the tool indicates the cut direction, and the dashed arrow indicates the stepover direction.

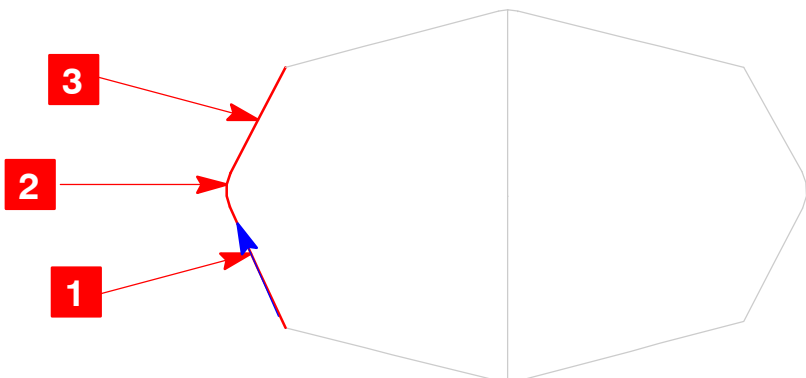
In the next steps, you'll select control lines so that the cutting passes cover the surfaces.

What: Pick the edges that form the first control line.

How:

Machining Parameters: Cut form

1. E26
2. E38
3. E28



Control Curve Sets form

 Change arrow direction, if necessary.

Don’t Close the Control Curve Sets form.

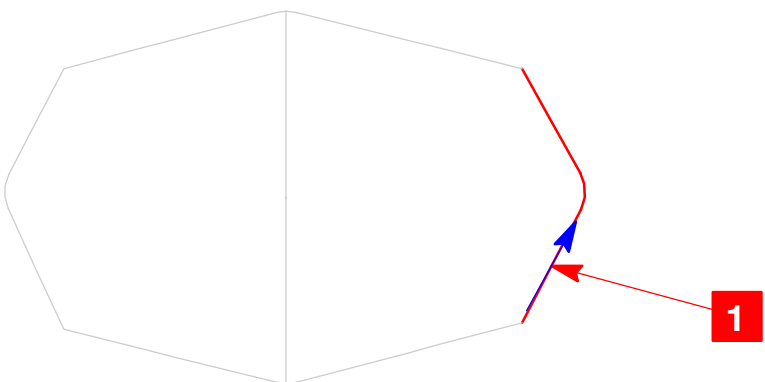
What: Pick the second control line.

How:

Control Curve Sets form

Turn Auto Chain On

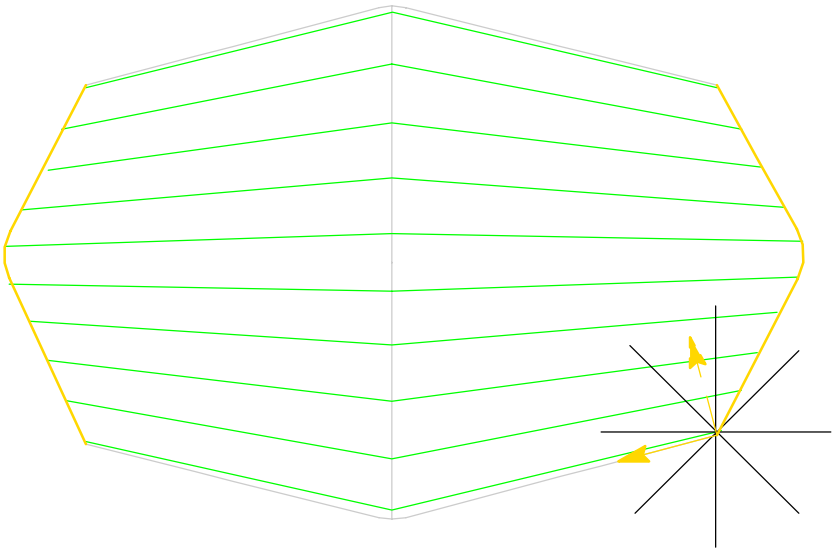
1 E18



Change arrow direction, if necessary.

OK

Don’t close the Machining Parameters: Cut form.



Things to notice

The preview of the toolpath entirely covers both surfaces. Keep in mind that the preview is a rough approximation of your toolpath. Use it to see the pattern and the direction of the cuts. Your actual toolpath will probably have more cutting passes than the preview.

If you want to see a closer depiction of your toolpath without generating it, pick the *Preview* icon on the Machining Parameters form.

Machining Parameters: Cut form

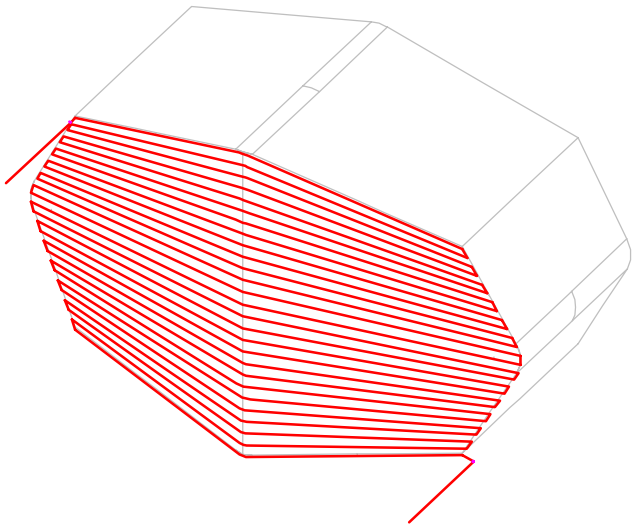
OK

Don't close the Operation Specification form.

What: Generate the toolpath.

How:

Operation Specification form



Things to notice

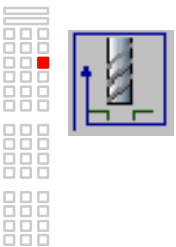
The toolpath covers the surfaces completely. The entry point of the toolpath begins at the end of the first flow line that you selected. Also, notice that the software created the connection moves between the cutting passes.

Recovery Point

File
Save

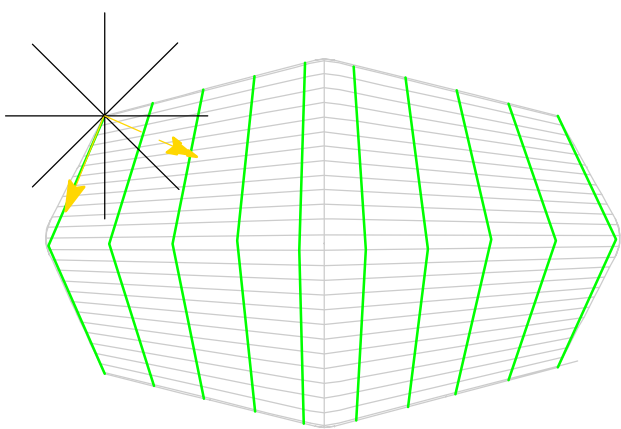
Now, you'll learn how to change the start point and the cut direction of the toolpath. By changing the start point and cut direction, you can not only change the entry and exit location, but also define climb and conventional machining. For this example, you'll change the direction of the cuts from horizontal to vertical.

How:



Operation Specification form

Machining Parameters: Cut form



 *OK*

Don't close the Operation Specification form.

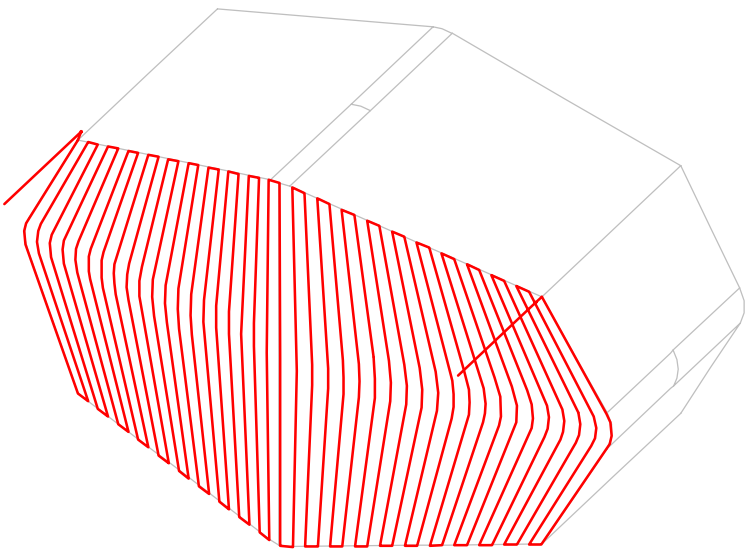
What: Generate the toolpath.

How:

Operation Specification form

I-DEAS Warning

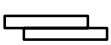
 *OK*



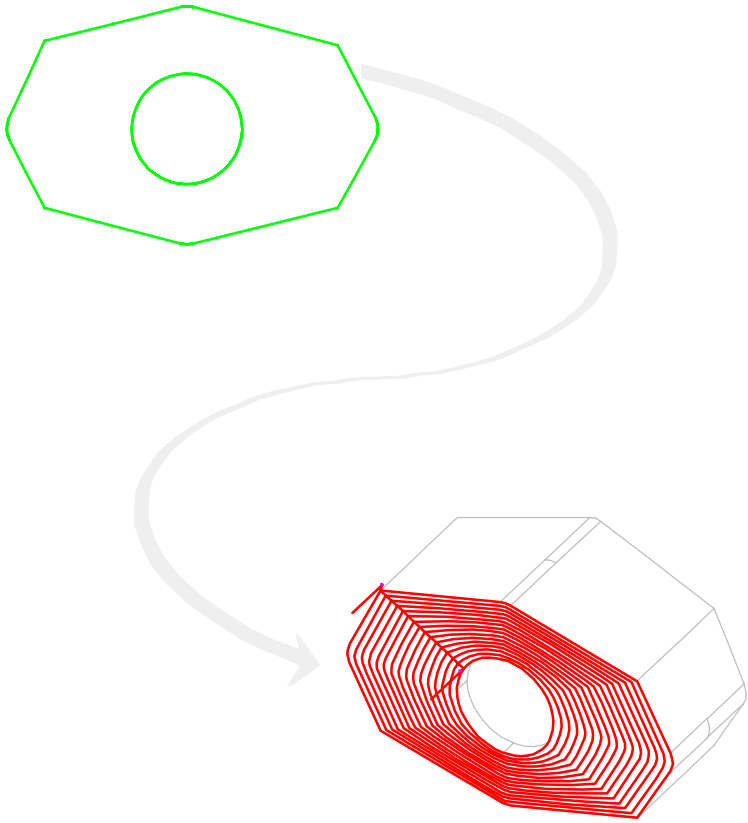
Things to notice

The tool cuts vertically along the surfaces now. By changing the cut and stepover directions, the control lines now become the flow lines.

Recovery Point

 *File*
Save

Here, you'll learn how to create a concentric cut pattern by picking flow lines only. The outer edge of the part forms the first flow line; the inner edge forms the second flow line. Because the flow lines form a closed boundary, you don't need to pick control lines.



What: Create a new setup.

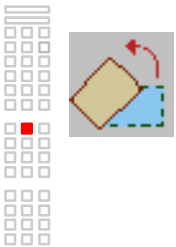
How:

Setup Specification form

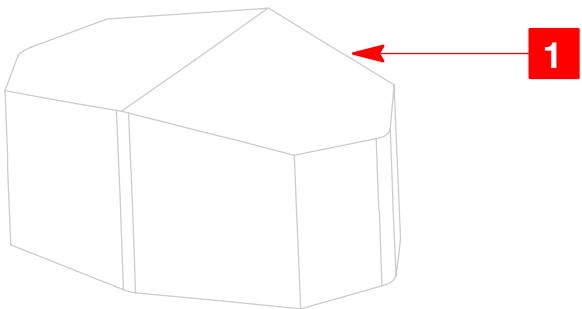
 *Dismiss*

What: Rotate the part about the X axis so the next surface aligns with the Z axis. Make sure you pick the part and not the sections that were created on the edges of the part.

How:



1 anywhere on the part



(twice)

Check *I-DEAS Prompt*.

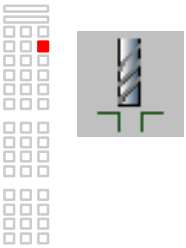
Enter rotation angles: 180, 0, 0

Recovery Point

File
Save

What: Create a flowline operation.

How:



Operation Selection form

Category: *Milling*

Type: *Flowline*

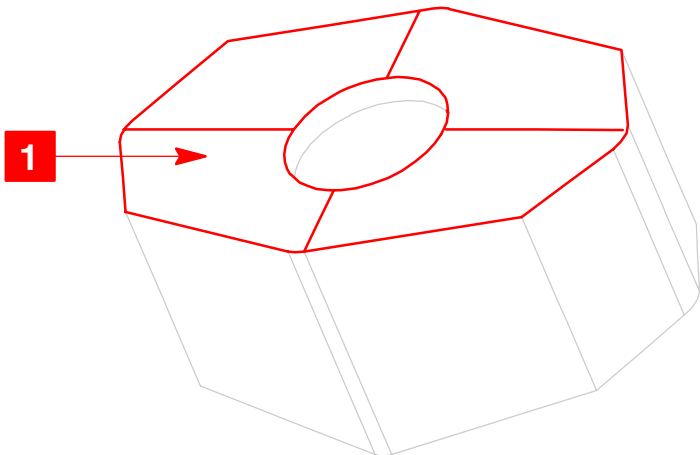
Create

Don’t close the Operation Specification form.

What: Pick the surface to be machined.

How:

Operation Specification form



Surface Selection form

 *Dismiss*

Don’t close the Operation Specification form.

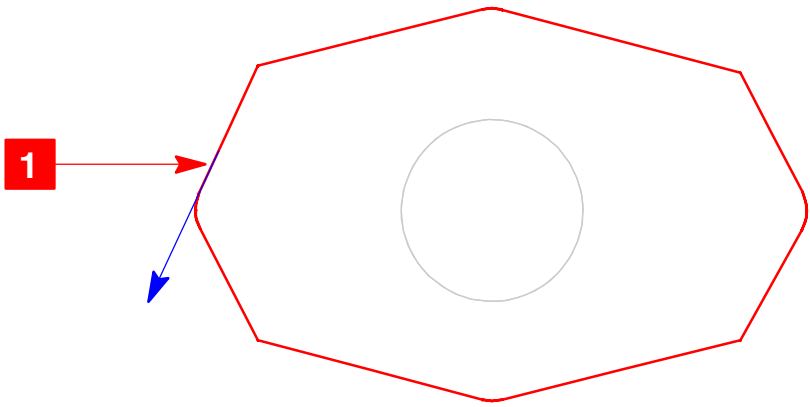
What: Pick the first flow line.

How: To make your toolpath appear similar to the one shown in this tutorial, pick E9 first.

Operation Specification form

Machining Parameters: Cut form

1 Pick the 12 outer edges.



Flow Curve Sets form

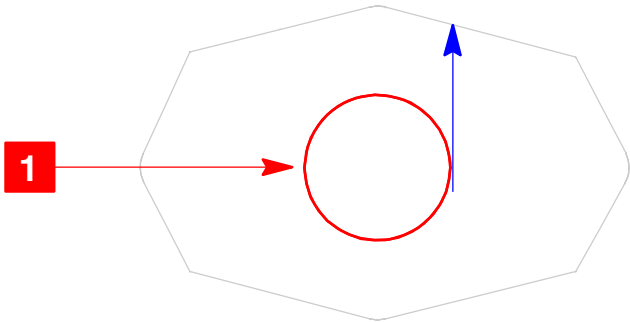
 Change arrow direction, if necessary.

Don’t close the Flow Curve Sets form.

What: Pick the second flow line.

How:

Flow Curve Sets form

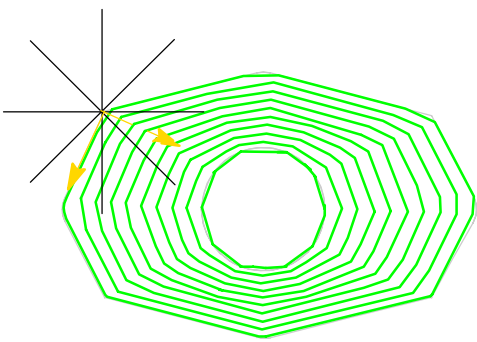



Change arrow direction, if necessary.


OK

Things to notice

The preview of the toolpath displays a concentric cut pattern. Again, the solid arrow shows the cut direction and the dashed arrow shows the stepover direction.



Machining Parameters: Cut form

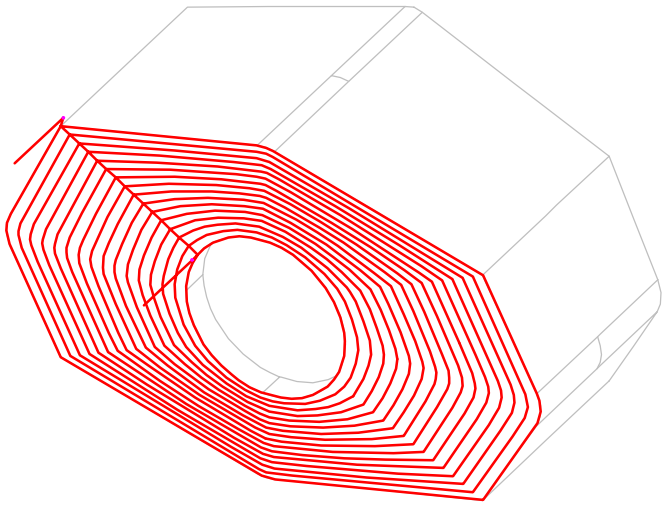

OK


Don’t close the Operation Specification form.

What: Create the toolpath.

How:

Operation Specification form



Things to notice

The tool follows a spiral pattern about the surface from one cut line to the next. In this instance, the stepover motions between the passes occur diagonally from the entry.

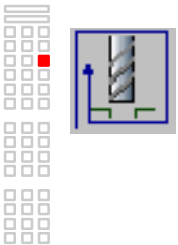
Recovery Point

File
Save

On your own...

What: Modify the operation to create radial cuts instead of spiral cuts.

How:



Operation Specification form

Machining Parameters: Cut form

- *Start Extension:* 25%
- *End Extension:* 25%

Generate the toolpath

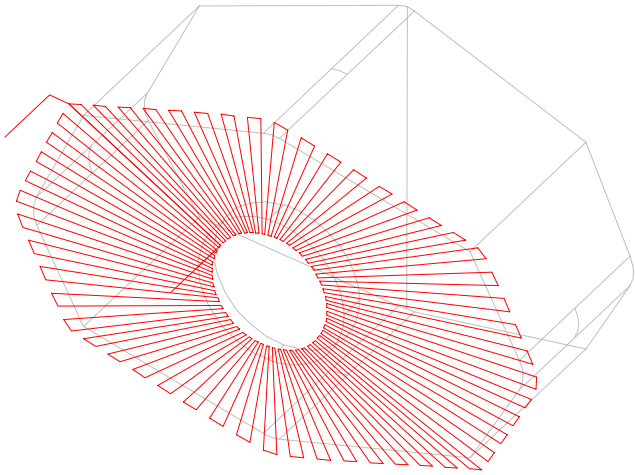
OK

Don’t close the Operation Specification form.

On your own...

What: Create the toolpath.

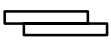
How:



Things to notice

The cutting passes no longer follow the edges of the part. Now the cuts radiate from the inner cut line. The start and end extension you added continue the cut strokes beyond the specified cut surfaces.

Recovery Point



File
Save

Tutorial wrap-up

You've completed the Creating Flowline Operations tutorial.